10th Class 2021		
Physics	Group-I	Paper-II
Time: 1.45 Hours	(Subjective Type)	Max. Marks: 48

(Part-I)

2. Write short answers to any Five (5) questions: (10)

(i) Define quality of sound.

Ans The characteristic of sound by which we can distinguish between two sounds of same loudness and pitch is called quality.

(ii) Define spring constant "K" and write down its unit.

Ans According to Hooke's law, this force is directly proportional to the change in length x of the spring *i.e.*,

$$F = -kx$$

where x is the displacement of the mass from its mean position O, and k is a constant called the **spring constant** defined as:

$$k = -\frac{F}{x}$$

The value of k is a measure of the stiffness of the spring. Stiff springs have large value of k and soft springs have small value of k.

Unit:

The unit of spring constant (k) is Nm^{-1}, newton per meter.

(iii) Define restoring force.

Ans The force exerted by the spring is always directed opposite to the displacement of the mass. Because the spring force always acts towards the mean position, it is sometimes called a restoring force.

A restoring force always pushes or pulls the object performing oscillatory motion towards the mean position.

(iv) Prove that: $v = f\lambda$

Ans The velocity of wave is defined as:

$$\text{Velocity} = \frac{\text{distance}}{\text{time}}$$

$$v = \frac{d}{t}$$

If time taken by the wave in moving from one point to another is equal to its time period T, then the distance covered by the wave will be equal to one wavelength, hence we can write

$$v = \frac{\lambda}{T}$$

But time period T, is reciprocal of the frequency f, *i.e.*, $T = \frac{1}{f}$.

Hence proved

$$v = f\lambda$$

(v) How does loudness depend on the area of vibrating body?

Ans **Area of the vibrating body:**

The loudness of sound depends upon the area of the vibrating body. For example, sound produced by a large drum is louder than that by small one because of its large vibrating area. If we strike a tuning fork on a rubber pad, a feeble sound will be heard. But if the vibrating tuning fork is placed vertically on the surface of a bench, we will hear a louder sound. From this, we can conclude that the loudness increases with the area of the vibrating body and vice versa.

(vi) Define pole and centre of curvature in spherical mirrors.

Ans **Pole:**

It is the midpoint of the curved surface of spherical mirror. It is also called vertex.

Centre of Curvature (C):

A spherical mirror is a part of a sphere. The centre of this sphere is called centre of curvature.

(vii) **Differentiate between the focus of convex mirror and concave mirror.**

Ans Differentiate Focus of a Concave and a Convex Mirror:

Convex Mirror	Concave Mirror
The focus lies behind the mirror.	The focus is in front of the mirror.
The focus is virtual as the rays of light after reflection appear to come from the focus.	The focus is real as the rays of light after reflection converge at the focus.

(viii) **What is meant by distance formula?**

Ans The equation relating the distance of the object p from the mirror/lens, distance of the image q and the focal length f of the mirror/lense is called mirror/lense formula, given by

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

3. Write short answers to any Five (5) questions: (10)

(i) **Define ohmic and non-ohmic conductors.**

Ans Materials that obey Ohm's law, and hence have a constant resistance over a wide range of voltages, are said to be ohmic. Materials having resistance that changes with voltage or current are non-ohmic.

(ii) **Define electric power and write its formula.**

Ans The amount of energy supplied by current in unit time is known as electric power.

Hence power P can be determined by the formula

Electric power P = electrical energy / time = W/t

where W is the electrical energy given by

$$W = QV$$

Therefore, above equation becomes

$$\text{Electric power} \quad P = \frac{QV}{t} = IV = I^2 R$$

(iii) Define electromotive force and write its unit.

Ans It is the energy supplied by a battery to a unit positive charge when it flows through the closed circuit. Or

The energy converted from non-electrical forms to electrical form when one coulomb of positive charge passes through the battery.

$$\text{Thus,} \qquad \text{e.m.f} = \frac{\text{Energy}}{\text{Charge}}$$

$$\text{or} \qquad E = \frac{W}{Q}$$

The unit for e.m.f. is JC^{-1} which is equal to volt (V) in SI system.

(iv) Define mutual induction.

Ans The phenomenon of production of induced current in one coil due to change of current in a neighboring coil is called mutual induction.

(v) State the right hand rule.

Ans A simple method of finding the direction of magnetic field around the conductor is the Right Hand Grip Rule.

Grasp a wire with your right hand such that your thumb is pointed in the direction of current. Then curling fingers of your hand will point in the direction of the magnetic field.

(vi) Draw the symbolic diagram for NAND gate and write its truth table.

Ans

NAND gate

A	B	$X = \overline{A+B}$
0	0	1
0	1	1
1	0	1
1	1	0

(vii) Define truth table.

Ans The truth tables are tables which give the values of the inputs and outputs of the basic types of logic gates or combination of such gates.

(viii) What is an electric current? Write its formula.

Ans The rate of flow of electric charge through any cross-sectional area is called current.

If the charge Q is passing through any area in time t, then current I flowing through it will be given by

$$\text{Current} = \frac{\text{Change}}{\text{Time}}$$

or $$I = \frac{Q}{t}$$

SI unit of current is ampere (A).

4. Write short answers to any Five (5) questions: (10)

(i) Define electric field intensity and write its equation.

Ans If F is the force acting on the test charge q_o, the electric field intensity would be given by

$$E = \frac{F}{q_o}$$

The electric field intensity at any point is defined as the force acting on a unit positive charge placed at that point.

SI unit of electric intensity is NC^{-1}.

(ii) Define unit of capacitance.

Ans SI unit of capacitance is farad (F).

If one coulomb of charge given to the plates of a capacitor produces a potential difference of one volt between the plates of the capacitor then its capacitance would be one farad.

(iii) Write two uses of capacitors.

Ans Following are two uses of capacitors:

1. Capacitors have wide range of applications in different electrical and electronic circuits.
2. They are also used for table fans, ceiling fans, exhaust fans, coolers, motors of washing machines, air-conditioners and many other appliances for their smooth working.

(iv) Explain the software component of computer-based information system.

Ans The term software refers to computer programs and the manuals that support them. Computer programs are machine-readable instructions that direct the circuitry within the hardware parts of the CBIS to produce useful information from data. Programs are generally stored on some input / output medium, often a disk or tape.

(v) What is optical fibre? Write its one advantage for transmission of data.

Ans Total internal reflection is used in fibre optics which has number of advantages in telecommunication field. Fibre optics consists of hair size threads of glass or plastic

through which light can be travelled. The inner part of the fibre optics is called core that carries the light and an outer concentric shell is called cladding. The core is made from glass or plastic of relatively high index of refraction.

(vi) **Write name of two web browsers.**

Ans The two web browsers are as follows;

1. Internet Explorer 2. Mozilla Firefox

(vii) **Define cosmic radiations and write its source.**

Ans The Earth, and all living things on it also receive radiation from outer space. This radiation is called cosmic radiation, which primarily consists of protons, electrons, alpha particles and larger nuclei. The cosmic radiation interacts with atoms in the atmosphere to create a shower of secondary radiation, including X-rays, muons, protons, alpha particles, electrons, and neutrons.

(viii) **What do you understand by half-life of a radioactive element?**

Ans The time during which half of the unstable radioactive nuclei disintegrate is called the half-life of the sample of radioactive element.

Every radioactive element has its own characteristic half-life.

(Part-II)

NOTE: Attempt any Two (2) questions.

Q.5.(a) Prove that motion of a simple pendulum is simple harmonic motion. (4)

Ans For Answer see Paper 2020 (Group-I), Q.5.(a).

(b) **Two capacitors of capacitances 12 μF and 6 μF are connected in parallel with a 12 V battery. Find the equivalent capacitance of the combination. Find the charge across each capacitor.** **(5)**

Ans **Given data:**

$C_1 = 6\ \mu F$

$C_2 = 12\ \mu F$

$v = 12\ v$

To find:

(i) $C_{eq} = ?$

(ii) $Q = ?$

Solution:

(i) Since capacitors are connected in series, therefore, equivalent capacitance will be:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

By putting values, we get

$$\frac{1}{C_{eq}} = \frac{1}{6} + \frac{1}{12}$$

$$= \frac{2+1}{12}$$

$$= \frac{3}{12}$$

$$C_{eq} = \frac{12}{3}$$

$$\boxed{C_{eq} = 4\ \mu F}$$

(ii) Since capacitors are connected in series, therefore, charge on each capacitor will be:

$$Q = CV$$

$$Q = 4 \times 10^{-6}\ F \times 12$$

$= 48 \times 10^{-6}$ F V

$\boxed{Q = 48\ \mu c}$

Q.6.(a) What is Solenoid? Explain the magnetic field of a Solenoid. (4)

Ans "A coil of wire consisting of many loops is called a solenoid."

Magnetic Field of a Solenoid:

The field from each loop in a solenoid adds to the fields of the other loops and creates greater total field strength. Electric current in the solenoid of wire produces magnetic field which is similar to the magnetic field of a permanent bar magnet. When this current-carrying solenoid is brought close to a suspended bar magnet, one end of the solenoid repels the north pole of the bar magnet. Thus, the current carrying solenoid has a north and a south pole and behaves like a magnet.

The type of temporary magnet, which is created when current flows through a coil, is called an electromagnet.

(b) An object 10 cm in front of a convex mirror forms an image 5 cm behind the mirror. What is the focal length of the mirror? (5)

Ans **Given that,**

$p = 10$ cm

$q = -5$ cm

To find,

$f = ?$

Solution:

Using mirror formula,

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$\frac{1}{f} = \frac{1}{10\ cm} + \frac{1}{(-5\ cm)}$$

$$\frac{1}{f} = \frac{1-2}{10\ cm} = \frac{-1}{10\ cm}$$

$$\boxed{f = -10\ cm}$$

Q.7.(a) What is meant by nuclear transmutation? Write the general equation of beta decay and also write an example. (4)

Ans The spontaneous process in which a parent unstable nuclide changes into a more stable daughter nuclide with the emission of radiations is called nuclear transmutation.

Now we represent radioactive decay by means of a nuclear equation in which an unstable parent nuclide X changes into a daughter nuclide Y with the emission of an alpha particle, beta particle or gamma particle.

Beta (β)-decay:

General Equation:

$$^{A}_{Z}Z \longrightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + \text{Energy}$$

parent nuclide — daughter nuclide — β-particle

Example:

$$^{14}_{6}C \longrightarrow {}^{14}_{6}N + {}^{0}_{-1}e + \text{Energy}$$

carbon — nitrogen — β-particle

In beta (β)-decay, the parent nuclide has its proton number Z increased by 1 but its mass number or nucleon number A remains unchanged.

(b) **The resistance of a conductor wire is 10 MΩ. If the potential difference of 100 volts is applied across its ends, then find the value of current passing through it in mA.** **(5)**

Ans Given that,

$$R = 10\ M\Omega = 10 \times 10^6\ \Omega$$
$$V = 100\ volts$$

To find,

$$I = ?$$

By using formula,

$$V = IR$$
$$I = \frac{V}{R}$$
$$I = \frac{100\ V}{10 \times 10^6\ \Omega}$$
$$I = \frac{100\ V}{10000000\ \Omega} = 0.00001A$$
$$I = 0.00001A \times 1000$$
$$\boxed{I = 0.01\ mA}$$